

Bioaccumulation Model Check-In

CPG-EPA Conference Call

October 15, 2018

General Overview of Proposed Approach

- Use FB4 model to do the following:
 - Develop species-specific consumption rate (GD)-to-growth rate (KG) simplified linear equation
 - Determine species-specific p-value
- Calculate either consumption rate (GD) or growth rate (KG).
- Then calculate use the GD-to-KG equation in FWM to calculate the other.

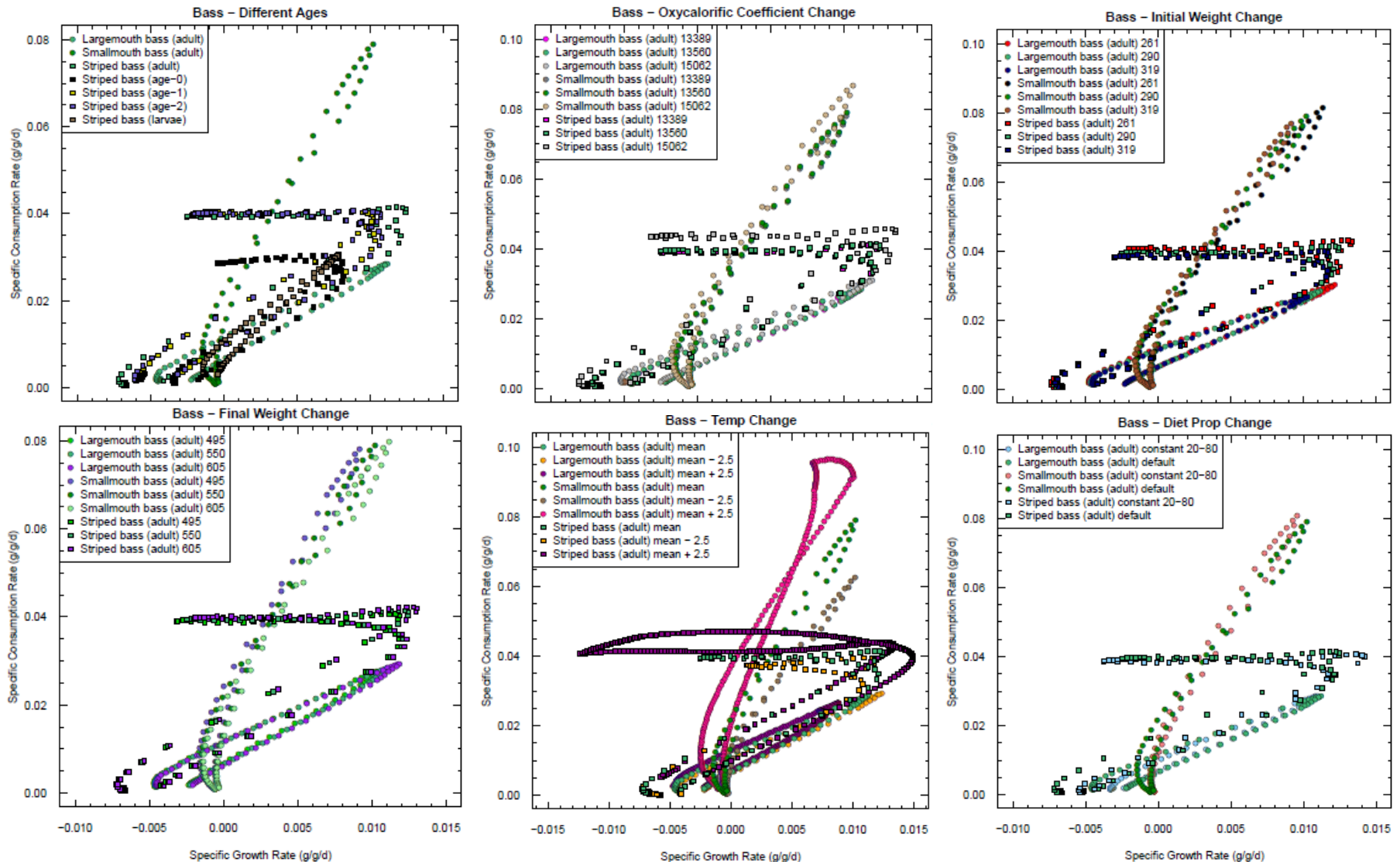
DEVELOPING GROWTH- CONSUMPTION RELATIONSHIP USING FB4 MODEL

Key Issues

- Evaluate FB4 model sensitivity (i.e., impact of other parameters on results).
- Must select surrogate species for each LPRSA FWM compartment.
 - Consider if some fish should be grouped
- Determine end weight for each species (i.e., estimated weight at end of one year)
 - Gewurtz equation
 - Research species-specific age-size relationships and use LPRSA data

Evaluating FB4 Model Sensitivity

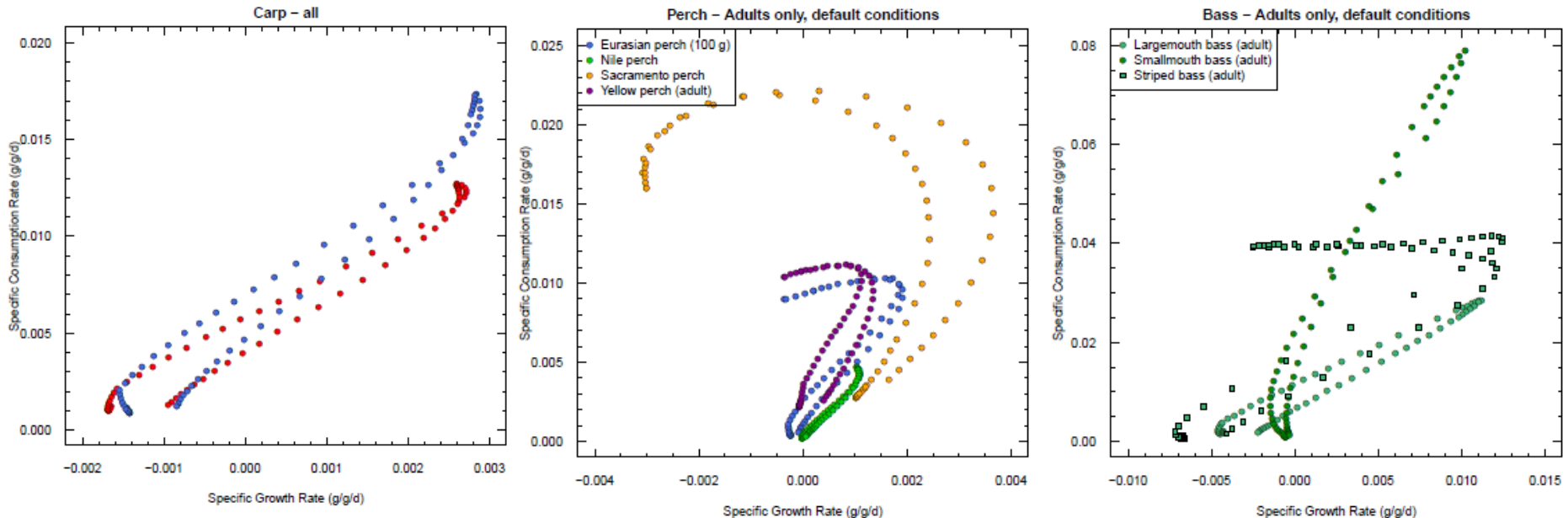
Example using Bass



Selecting Surrogate Species

LPRSA FWM	Possible FB4 Surrogates
<u>Invertebrates</u>	
Benthic invertebrates	None. <i>Keep same as current Arnot & Gobas model?</i>
Blue crab	Blue crab (using external paper)
<u>Fish</u>	
Filter feeding fish	None. <i>Use same model as small forage fish?</i>
Small forage fish	Bluegill sunfish, California killifish
Carp	Bighead carp, silver carp
Catfish	Brown bullhead
White perch	Yellow perch, Eurasian perch, Nile perch, Sacramento perch
American eel	None. <i>Consider bass as surrogate?</i>
Bass	Largemouth bass, smallmouth bass

Selecting Surrogate Species



- Carp – bighead and silver carp models appear similar; use both.
- Perch – selected yellow perch
- Bass – selected largemouth bass

Determining Year-End Weight

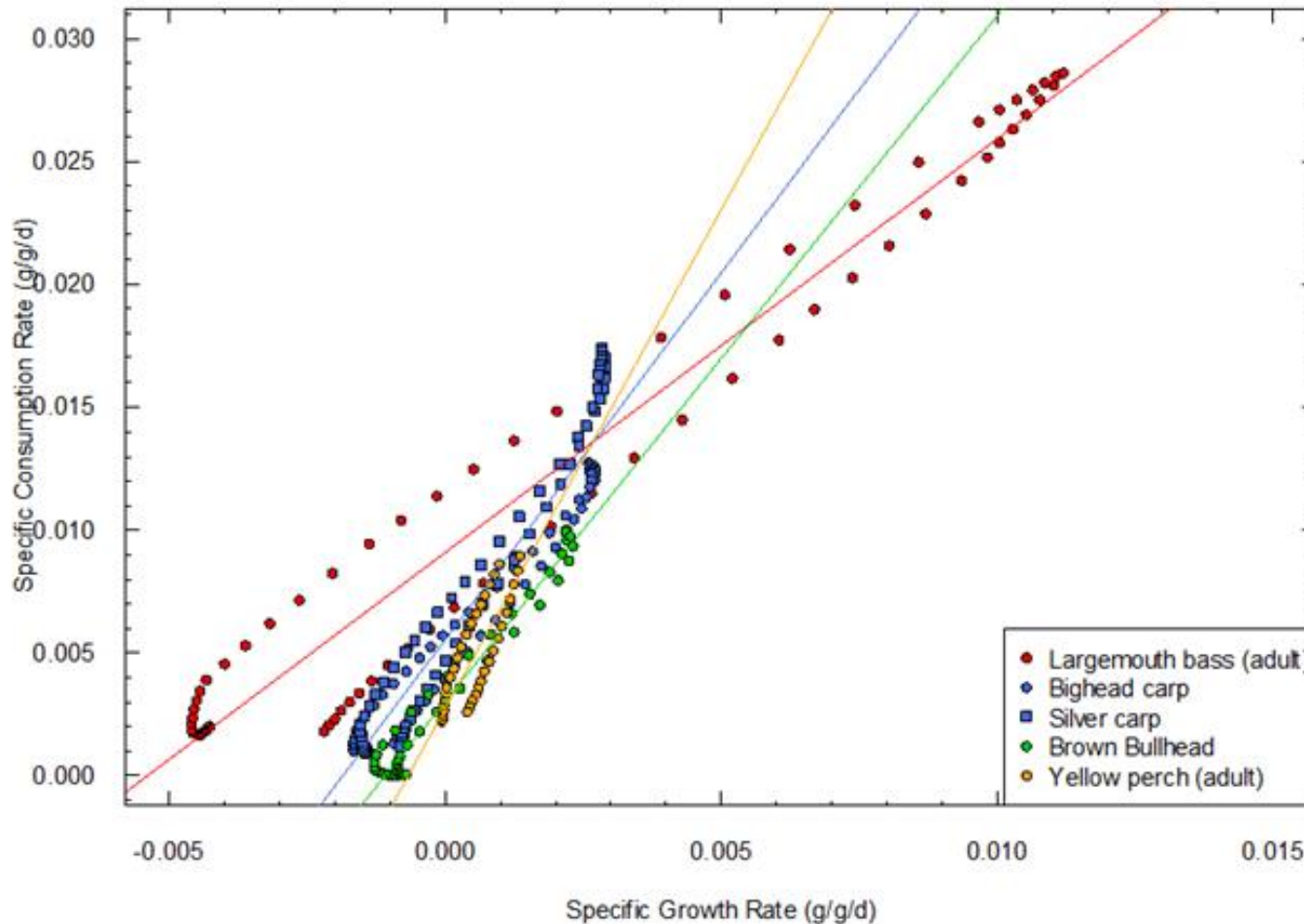
- Determine year-end weight for entry into FB4 model
 - Research species-specific age-size relationships (e.g., species-specific) von Bertalanffy growth equation and apply to LPRSA data.
 - Compare with predictions based on Gewurtz equation.

Year-End Weights – Growth Equations

- Comparison of Gewertz and Von Bertalanffy
- Gewertz provides reasonable estimation of growth for some species, but over-estimates growth for others.

LPRSA Species	Starting Weight (kg)	End Weight (kg)						No. of FishBase Studies
		Gewertz Growth Equation		von Bertalanffy Growth Function (VBGF) using Parameters from FishBase				
				Best Estimate Scenario		Range of VBGF Results based on Temperature Range		
		Weight	% Increase			Weight	% Increase	
Small forage fish	0.0027	0.009	233%	0.0044	63%	0.0043 - 0.0049	60 – 82%	6
Small American eel	0.16	0.28	75%	-	-	-	-	-
Blue crab	0.14	0.24	71%	-	-	-	-	-
Carp	3.1	4.2	35%	3.6	15%	3.4 - 3.7	9 – 20%	5
Catfish	0.88	1.3	48%	1.1	20%	na	na	1
White perch	0.094	0.17	81%	0.13	37%	0.13 - 0.13	37 – 40%	2
Large American eel	0.37	0.59	59%	-	-	-	-	-
Smallmouth bass	0.29	0.47	62%	0.47	61%	0.46 - 0.51	57 – 76%	5
Largemouth bass	0.29	0.47	62%	0.51	77%	0.45 - 0.57	57 – 96%	8
Bass (combined)	0.29	0.47	62%	0.49	68%	0.45 - 0.51	56 – 77%	13

Status of Selecting Final Relationships



Currently working on developing models for other FWM species
(e.g., blue crab and small forage fish)

Status of Selecting Final Relationships

Species	FB4 Surrogate	Equation	R ²
<u>Invertebrates</u>			
Benthic invertebrates	Keep same equations as currently in FWM?		
Blue crab	Blue crab	In progress	
<u>Fish</u>			
Small filter feeding fish	Use SFF model?		
Small forage fish	Bluegill or killifish	In progress	
Carp	Bighead/silver carp	$C = 0.005571 + G * 2.982$	0.93
Catfish	Brown bullhead	$C = 0.003081 + G * 2.79$	0.96
White perch	Yellow perch	$C = 0.002816 + G * 4.056$	0.74
American eel	Use bass model?		
Bass	Largemouth bass	$C = 0.009114 + G * 1.684$	0.96

Where:

C = specific consumption rate (g/g/d)

G = specific growth rate (g/g/d)

CALCULATING GROWTH OR CONSUMPTION

Options for FWM Implementation

- Need to either start by calculating growth or consumption.
- Use method(s) not selected to help verify that calculated values are realistic.

Calculate...	Pros	Cons
Growth – using Gewurtz equation	<ul style="list-style-type: none">• Simple equation• Already in FWM	<ul style="list-style-type: none">• May over-estimate growth
Growth – based on literature-derived von Bertalanffy equation combined with LPRSA data	<ul style="list-style-type: none">• May provide more realistic growth estimate.	<ul style="list-style-type: none">• Need to derive for all species (parameters not available for all).• Uncertainty in use of literature-derived values.
Consumption – using FB4 consumption rate sub-model #2	<ul style="list-style-type: none">• Parameters available in FB4 model for most species.	<ul style="list-style-type: none">• More complex equation to implement in FWM.• Requires input of uncertain p-value.